

MEDICAL PRACTICE

Hospital Topics

Which patients are likely to die in an accident and emergency department?

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Abstract

Four hundred and eighty-eight deaths occurring in an accident and emergency department over five years were analysed. Their causes were categorised as medical, surgical, or traumatic. Medical causes accounted for 87% of the deaths, of which 60% were from cardiac conditions. Blood loss was an important factor in over half the deaths from surgical and traumatic causes.

Lives might have been saved by considering infectious disease in patients with medical conditions and by undertaking more rapid blood transfusion, earlier chest drainage, and lateral cervical spine x rays in appropriate surgical or traumatic cases. The admission to casualty departments of people with terminal neoplasms should be discouraged. The management of medical emergencies should be emphasised when training accident and emergency department staff.

Introduction

No reports have been published on the causes of deaths occurring in accident and emergency departments. With the rapid development of the specialty of accident and emergency

medicine we thought it appropriate to produce accurate statistics concerning critically ill patients arriving in a busy accident and emergency department, and to highlight the conditions most likely to cause death. As the term "critically ill" is virtually impossible to define and measure accurately, we decided to analyse patients whose conditions deteriorated rapidly and who died while still in the accident and emergency department.

We carried out the survey in East Birmingham Hospital, one of the largest district general hospitals in the United Kingdom, which houses the regional units for infectious diseases and thoracic surgery but has no gynaecological or obstetric beds. The catchment area is mostly urban and industrial but includes an international airport, a major railway station, and the National Exhibition Centre. Although Birmingham has an internationally recognised accident hospital, this is situated on the opposite side of the city. The East Birmingham Hospital therefore manages the accidents occurring in its own catchment area. About 54 000 new patients a year arrive at the accident and emergency department, and there has been little variation over the past five years. All emergency cases, including urgent referrals by family doctors, are admitted through the department.

Methods

We carried out a retrospective survey of all deaths that occurred in the accident and emergency unit during the five years 1978-82. Patients who were dead on arrival in the department were excluded from the survey, except for some infants.

We obtained from the casualty record book the names and general details of all the patients who died in the department, and checked these patients' hospital notes. To verify the causes of death we checked the counterfoils of appropriate death certificates issued at the hospital, reports from the coroner's office, necropsy reports, and information obtained from the office of the City of Birmingham registrar of births, deaths, and marriages. The patients were then divided into three main categories—medical, surgical, and traumatic.

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OVERALL PICTURE

There were 488 deaths (307 in men, 181 in women) in the five years and in only one case was the cause unobtainable. The annual rate ranged from 83 to 118 with a mean of 98.

Table I shows the numbers of deaths in 10 year age groups and the numbers of necropsies performed in each age group. Seventeen deaths were recorded in children aged 1-10, dropping to four among those aged 21-30, and rising to 136 in people aged 61-70 and 134 in those aged 71-80. Necropsies were undertaken in 226 (46.3%) deaths and in virtually all patients who died aged under 40.

TABLE I—Age distribution of 488 people who died in a major accident and emergency department during 1978-82*

Age (years):	<10	10-20	21-30	31-40	41-50	51-60	61-70	71-80	≥81	Unknown
No of deaths	17	9	5	8	28	82	136	134	55	13
No of necropsies	17	9	4	8	20	36	65	38	25	4

*Details were not available for one patient.

DEATHS FROM MEDICAL CAUSES

Table II shows the 424 (87%) deaths from medical causes divided into 11 broad groups. Over 40% of these deaths (171 cases), resulted from myocardial infarcts, all patients having undergone 12 lead electrocardiography on arrival, followed by cardiac monitoring.

TABLE II—Causes of death in 488 patients who died in a casualty department. The causes are classified as medical, surgical, and traumatic and ordered according to prevalence

Diagnosis	Men	Women	Total	No of necropsies
<i>Medical causes</i>				
Myocardial infarct	121	50	171	51
Heart failure	45	36	81	30
Respiratory conditions	28	13	41	17
Cerebrovascular accidents	14	24	38	11
Carcinomatosis	23	8	31	9
Pulmonary embolus	3	17	20	16
Sudden infant death syndrome	7	3	10	10
Self poisoning	5	3	8	8
Asthma	3	4	7	5
Bacterial conditions	6	0	6	5
Miscellaneous conditions	7	4	11	10
Total	262	162	424	172
<i>Surgical causes</i>				
Ruptured aortic aneurysm	12	3	15	13
Gastrointestinal haemorrhage	8	3	11	6
Peritonitis	5	5	10	9
Pneumothorax	3	0	3	2
Total	28	11	39	30
<i>Traumatic causes</i>				
Multiple injuries	9	5	14	14
Head and neck	4	2	6	6
Chest	2	0	2	2
Other	1	1	2	2
Total	16	8	24	24

The ratio of men to women was 5:2, and the youngest was a man of 28. Death from either right or left heart failure was recorded on 81 occasions. One unusual case was in a child of 18 months who had a single ventricle. All other deaths from heart failure were recorded in patients over 50. Again electrocardiography was followed by cardiac monitoring.

Only 41 patients died from respiratory conditions, which was the third most common cause of death. The two youngest were in the age range 41-50 and their deaths were reported at necropsy as being due to viral pneumonitis. The remaining deaths, except that of a patient with Addison's disease on steroids, were the result of chronic obstructive airway disease or bronchopneumonia in elderly patients. No deaths were thought to have been due directly to carcinoma of the bronchus.

Of the 38 deaths due to a cerebrovascular accident, 24 occurred in

women. This category was one of only two in the survey with a predominance of women. Four patients were recorded as having subarachnoid haemorrhage while one was noted to have leukaemia. Half of the patients (19) were aged 71-80.

Among the 31 deaths due to carcinomatosis few necropsies were performed, as the disease was known to be widespread before the patients were admitted to hospital. The most common primary site was the bronchus (14 patients), followed by blood dyscrasia (four) and the stomach (four). In three patients the primary site of the disease was never established.

Over four fifths of deaths from pulmonary embolus occurred in women. The youngest was an active sportswoman in her early 30s who had sustained a penetrating wound of the left knee. Debridement had been performed, and after 48 hours the patient had been discharged walking with her leg in a plaster cylinder. She was brought into the accident unit moribund five days later. Of the 20 deaths in this category, eight occurred in the last year of the survey and 16 were followed by necropsies.

Ten infants, all under 1 year, died in the accident and emergency department despite intensive attempts at resuscitation. The diagnosis of sudden infant death syndrome was made and later confirmed at necropsy.

East Birmingham Hospital treats more cases of self poisoning a year than any other hospital in the city, but only eight deaths feature in this survey. One was in a youth of 17 who died having inhaled vomit after sniffing butane. Two patients died suddenly from salicylate poisoning.

The seven deaths from asthma were in young patients. All were negligent with their medication and had previously had emergency admissions to hospital.

Six patients died from a variety of bacterial infections, the diagnoses being made only at necropsy. Two were infants who died from purulent meningitis; an emaciated young Irishman who was thought to be suffering from a terminal malignancy was found at necropsy to have died from miliary tuberculosis; two patients had septicaemia after infection of a knee joint; and an elderly patient with a fracture of the neck of the femur was stated at necropsy to have died from suppurative pericarditis.

In the patients who died from miscellaneous conditions, the most common cause of death was hypothermia, which was seen in three elderly patients. There were also three cardiac deaths: a man of unknown age who died of rheumatic aortic stenosis, a child with myocarditis, and a young athlete with an influenzal myocarditis. Two patients, one known to be epileptic, died because of inhaling vomit. The only patient in this category for whom a necropsy was not performed was a middle aged man known to be suffering from severe motor neurone disease.

DEATHS FROM SURGICAL CAUSES

Table II shows the small number (30) of deaths from surgical causes divided into four broad groups. There was a pronounced predominance of men, and the only death which occurred in a patient under 50 was in a man of 33 who was diagnosed at necropsy as suffering from pancreatitis.

The most common cause of death from a condition requiring surgery was a ruptured aortic aneurysm, which occurred in 15 patients, more than half of whom were over 70. All were transfused with blood. Gastrointestinal haemorrhage was the second most common surgical cause of death, and in all but three patients the underlying condition was known before they were admitted to hospital. The haemorrhages were all the results of peptic ulceration or diverticulitis except for a single massive bleed from a laryngeal neoplasm.

The deaths classified as being due to peritonitis were the most varied and included that of the man with pancreatitis. Most resulted from a variety of gastrointestinal perforations, although they included a case of ischaemic colitis after a mesenteric embolus and a woman with a strangulated femoral hernia.

The three remaining deaths from surgical causes were the result of pneumothoraces, one of which was bilateral and was not suspected before death.

DEATHS CAUSED BY TRAUMA

This category had the smallest number of deaths and a ratio of men to women of 2:1. The aetiology varied considerably, but most deaths were the result of road traffic accidents. Unlike in the other

major categories there was an even age distribution. Necropsies were performed on all patients. The deaths were again divided into four groups.

Multiple injuries accounted for more than half the deaths. There was usually a serious head or trunk injury as well as injured limbs. One woman in her 70s had fractures in an arm and also what appeared to be a minor fracture of the pelvis. Although a blood transfusion had been started promptly, she died from a massive pelvic haemorrhage.

Six patients with head injuries were admitted to the unit unconscious and soon died. No other obvious injuries were noted, but fractures or dislocations of the cervical spine were found in five at necropsy. Two patients died of severe chest trauma despite prompt drainage and ventilation; one was found to have a ruptured aorta at necropsy. One of the two other deaths was in a child found to have a ruptured spleen; the other was a classic butchers' injury in which an unsupervised youth boning a carcass severed his right femoral artery. In the ensuing panic little first aid was carried out, and he arrived at hospital exsanguinated and died despite heroic attempts at resuscitation.¹

Discussion

The striking feature of this survey was the large number of deaths that occurred in the accident and emergency department, 87% of which were from conditions traditionally managed by physicians rather than surgeons. An analysis of the medical deaths showed that, not unexpectedly, 60% were due directly to cardiac conditions. Despite necropsies having been performed on only 32% of these patients, the diagnoses were probably correct as all patients underwent initial electrocardiography and cardiac monitoring. As cardiological conditions cause such a large mortality this subject should surely be emphasised in the training of doctors embarking upon a career in accident and emergency medicine.

The pathetic picture of 31 patients with terminal neoplasms dying in a busy accident and emergency unit should be avoided: it is undignified for the patient and distressing for relatives. Unfortunately patients and their relatives tend to rely increasingly on hospital care in terminal illness.

The 20 deaths from pulmonary emboli, with a great predominance in women, are interesting. One possible explanation is that patients known to have been discharged early from hospital following surgery in the past may have died as hospital inpatients.

Not all of the deaths from the sudden infant death syndrome should have been classified as deaths in the accident and emergency department, because several of the infants were almost certainly dead before their arrival at hospital. But in such an emotional situation it would have seemed heartless not to have at least attempted resuscitation before certifying death.

The sudden deaths from asthma cause concern. All were in young patients who did not comply with their treatment regimens. It is hard to see what further measures can be taken other than health education and emphasising to staff the hazards of administering bolus aminophylline to patients already receiving the drug.^{2 3}

A lesson learnt from the survey was the importance of considering an infectious disease in critically ill people when the diagnosis is in doubt. There were six deaths from potentially curable infectious conditions. Malaria must always be excluded in any patient who has been abroad.

Massive haemorrhage was an important factor in well over half the deaths in the surgical and traumatic categories. Although all such patients were rapidly transfused, often initially with volume expanders, blood transfusions started earlier and given more rapidly in larger amounts might have lowered this mortality. Five deaths from chest lesions occurred in these categories, and earlier chest drainage of patients with pneumothoraces might have saved lives. A significant finding in deaths caused by trauma was that of the six patients with fatal head injuries five were found at necropsy to have fractures or dislocations of the cervical spine, which emphasises the advisability of undertaking a lateral cervical x ray in all patients with severe head injuries.

Three deaths resulted from the inhalation of vomit, possibly in the department. To avoid such tragedies the importance of clearing and maintaining an airway should be emphasised to all accident and emergency staff.

With the rapid development of the specialty of accident and emergency medicine and the current debate on training programmes, our findings suggest that a much greater emphasis should be placed on the management of "medical" emergencies, as these cause most of the deaths that occur soon after admission to hospital, often before specialist opinions can be obtained.

We thank the medical records staff at East Birmingham Hospital, the coroner's officers at the coroner's court, Birmingham, and the registrar of births, deaths and marriages of the City of Birmingham, without whose help it would have been difficult to verify the cause of death in many cases.

References

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- 2 Thomson PJ, Hay JG. Dangers of compound drugs and intravenous aminophylline. *Lancet* 1982;ii:1228.
- 3 Stewart MF, Barclay J, Warburton R. Risk of giving intravenous aminophylline to acutely ill patients receiving maintenance treatment with theophylline. *Br Med J* 1984;288:450.

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Employees sometimes have to work in a boiler house on a hot day attired in enclosed neoprene suits. We advise such workers to drink plenty of fluid before, during, and after their shift. Should they also be advised to take salt tablets; and if so how much salt should they take within the limitations of what is thought to be best for their health?

It is not immediately clear why these employees working in a boiler house on hot days need to wear an impermeable suit made from artificial rubber (neoprene). Unless other factors dictate this choice, thought should be given to the provision of protective suits made from a "breathable" fabric that would allow the moisture from sweat to transpire through the fabric. Information on such material is available either from: Industrial Safety (Protective Equipment) Manufacturers Association, 69 Cannon Street, London, or the Shirley Institute, Didsbury, Manchester M20 8RX. That could lessen the heat load. The questioner is correct in advising workers to replace water loss by drinking during, as well as after, work. Frequent small drinks during exposure are very acceptable under these conditions and should be

encouraged. Whereas it has traditionally been the custom to provide salted drinks or salt tablets to workers in these conditions, this practice has recently been questioned.¹ It is suggested that even for a man sweating profusely, salt balance can often be maintained with an intake of 5 g daily² and that may simply be made available at meal times. If salt has to be replaced during heat stress rather than at meal times it should be provided in fluid concentrations of less than 0.3% NaCl.³ If there is an excessive intake of salt by mouth fluids may be drawn from the tissues, leading to intracellular water loss. Symptoms may include cramp, nausea, vomiting, and diarrhoea. In the past the occurrence of one or more of these symptoms has tended to be ascribed to salt deficiency without further thought.—W R LEE, professor of occupational health, Manchester.

¹ Industrial Medical Association. Statement. *JOM* 1971;13:43.

² Sohar E, Adar R. Sodium requirements in Israel under conditions of work in hot climates. In: *Proceedings of Lucknow symposium 1962*. UNESCO: Arid Zone Research, 1964.

³ Strydom NB. Physical work and heat stress. In: Zenc C, ed. *Occupational medicine*. Chicago: Year Book Medical Publishers, 1975.